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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/930,365	08/15/2001	Masahiro Takeuchi	15.45/6059	3437
24033	7590	12/29/2005	EXAMINER	
KONRAD RAYNES & VICTOR, LLP			HU, SHOUXIANG	
315 S. BEVERLY DRIVE			ART UNIT	
# 210			PAPER NUMBER	
BEVERLY HILLS, CA 90212			2811	

DATE MAILED: 12/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

**Office Action Summary**

Application No.

09/930,365

Applicant(s)

TAKEUCHI, MASAHIRO

Examiner

Shouxiang Hu

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 16 March 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 20-26, 40-56, 60, 61 and 63-67 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 20-26, 40-56, 60, 61 and 63-67 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☒ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)             | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)     | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### ***Claim Objections***

Claims 20-26, 40-56, 60-61 and 63-67 are objected to because of the following informalities and/or defects:

Claims 24, 40, 44, 60 and 63 each recite the subject matters of thermally treating "the dielectric layer", but fail to clarify that only a portion of the originally deposited dielectric layer remains in the recited "thermally treating" step.

Claim 20 is further objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The recited further step (of removing the stopper layer) in claim 20 is already recited in claim 24.

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 21-24, 40-46, 48-49, 51 and 54 are rejected under 35 U.S.C. 102(b) as being anticipated by Moore (Moore et al., US 6,051,480).

Moore discloses a method for manufacturing a semiconductor device having a trench isolation region, the method (Figs. 1-5; and Steps 100-750) comprising the process steps of: providing a semiconductor substrate (a lower portion of 10) with a first layer (the upper portion of 10; naturally a device layer) thereon; forming a pad layer (20; SiO<sub>2</sub>); forming a layer that naturally functions as a polishing stopper layer (30; SiN); forming a trench by etching the first layer (see Fig. 1B) while using the polishing stopper layer as at least a part of a etching mask; thermally oxidizing the first layer to form a trench liner (50; 15 nm); forming a dielectric layer (60) in and above the trench; planarizing the dielectric layer that naturally uses the polishing stopper layer as a stopper (as the silicon nitride layer 30 has been naturally exposed and ready to be removed after the step of polishing, see col. 4, lines 17-33); removing the polishing stopper layer (30); removing the pad layer (Fig. 1F) through wet-etching (HF-based solution, see col. 4, lines 35-46; ) that is naturally substantially isotropic in natural (as compared with certain anisotropic dry-etching method); forming a sacrificial oxide layer (70, or 80a, or 80); then thermally annealing the substrate that also naturally thermally treats the remaining dielectric layer (as it is naturally together with the substrate) at a temperature in a range of above 900 °C (col. 4, lines 57-67; with oxygen, see col. 5, lines 1-3) which naturally covers or overlaps with the recited temperature of 1050 °C or 1250 °C or above; then implanting impurities into the first layer that naturally forms a impurity well therein; and, then removing the entire sacrificial oxide layer (step 650).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 20, 25-26, 47, 50, 52-53, 55-56, 60-61 and 63-67 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moore.

The disclosure of Moore is discussed as applied to claims 21-24, 40-46, 48-49, 51 and 54 above.

Moore does not expressly disclose: that the first layer can be an epitaxial growth layer (as recited in claims 20, 55 and 63-67); that the oxygen volume can be 0.1% to 10% in volume (as recited in claim 25); that the dielectric layer can be formed with a high density plasma CVD method (as recited in claims 26, 50 and 66); that the dielectric layer can have a film density of at least 2.1g/cm<sup>3</sup> (as recited in claims 47 and 65); that the temperature for the thermal oxidization of the trench liner can be 700 (or 950) to 1150 °C (as recited in claims 52 and/or 53); that the trench can have a width of no greater than 0.35 um (as recited in claim 56); and/or, that the step of forming the trench is carried out after removing a patterned photoresist above the stopper layer (as recited in claims 60-61).

However, it is noted that the volume (or partial pressure) of oxygen, the film density for the dielectric layer, the width of the trench and the thermal oxidation temperature are each and all art-recognized result-oriented parameters of importance

subject to routine experimentation and optimization, and the recited numbers are well within the art-recognized respective common ranges for these parameters.

And, it is also noted that the high density plasma CVD method is an art-known method commonly used for forming an oxide film with good quality.

Furthermore, one of ordinary skill in the art would readily recognize: that the first layer can be an epitaxial growth layer thicker than 2  $\mu\text{m}$  for obtaining desired substrate quality and/or property (as readily evidenced in the prior art such as Li et al., US 6,064,105; of record; see the layer 112 in Fig. 3); and, that the step of forming the trench is commonly carried out after removing the patterned photoresist above the stopper layer for better trench-etching control (as readily evidenced in the prior art such as Manley et al., US 6,221,735; of record; see Figs. 1A-1C; wherein the naturally-involved patterned photoresist has been removed in Fig. 1B).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to develop the method of Moore with the volume of oxygen, the film density of the dielectric layer, the width of the trench, and/or temperature of the thermal oxidation each and/or all having the respective recited art-known numbers, and/or, with the art-known epitaxial growth layer and/or the art-known step of removing the patterned photoresist prior to the etching of the trench being incorporated thereinto, so that a method for making a semiconductor device with desired and/or optimized performance would be obtained.

***Response to Arguments***

Applicant's arguments with respect to the above rejected claims have been considered but are moot in view of the new ground(s) of rejection.


***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is 571-272-1654. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SH  
December 22, 2005



**SHOUXIANG HU  
PRIMARY EXAMINER**